Open Access
J. Sustain. Econ. Dev., 2025, 3(2):195-213
ISSN (Online): 3005 -2513; ISSN (Print):3005-2505
DOI: https://doi.org/10.22194/JSD/25.07
https://societyfia.org/journal/JSD

Fiscal Decentralization, Governance and Poverty Nexus in Pakistan

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This study underscores the interconnectedness of fiscal decentralization, governance, and poverty in Pakistan. It marks the inaugural utilization of six distinct types of fiscal decentralization to assess their impact on governance and poverty, employing separate models dedicated to each type. The study employed annual time series data spanning from 1996 to 2022, using ARDL estimation to unveil the empirical findings. The primary objective of this research was to investigate how improvements in governance through fiscal decentralization could alleviate poverty in Pakistan. The study concluded that fiscal decentralization has a negative impact on poverty. All six types of fiscal decentralization contribute to poverty reduction, but expenditure decentralization, whether adjusted or unadjusted, stands out as one of the most effective tools for rapid poverty reduction. Governance was also found to be significantly and negatively correlated with poverty. The study suggests that the key is to enhance fiscal decentralization, particularly revenue decentralization, in order to alleviate poverty in Pakistan.
Keywords: Fiscal decentralization, governance, poverty, ARDL.

INTRODUCTION

Governance practices associated with the federal government, specifically how and what they do, have been a subject of worldwide interest in recent years. The focus has been on challenging the federal government's monopoly on policy-making in both developing and developed countries. Fiscal decentralization, a strategy widely employed in the Western world, aims to revamp government organizational structures to transition away from the "post-welfare state" towards cost-efficient delivery of goods and services (Wildasin, 1997; Bennet, 1990). In Central and Eastern Europe, fiscal decentralization has played a pivotal role in shifting systems from socialist regimes to democracies and market economies (Bird et al., 1995). In developing countries, the adoption of fiscal decentralization is driven by the need to address inadequate economic growth, macroeconomic instability, and inefficient governance (Bird and Vaillancourt, 1999).

To enhance financial and economic management, fiscal decentralization proves to be an effective approach. While it may not resolve all economic issues, it greatly improves the system of public administration. The primary objective of fiscal decentralization in public services is to achieve increased efficiency. Lower or local governments perform better since they are closer to the people, as suggested by Stigler in 1957. The policies of decentralized government branches differ from those of the federal government, as they better reflect the preferences of residents, as noted by Musgrave in 1959. Oates articulated the decentralization theorem, which posits that "each public service should be provided by the jurisdiction that has control over the minimum geographic area necessary to internalize the benefits and costs of such provision" (Oates, 1972). Fiscal decentralization is considered more beneficial because it is more likely to result in higher economic development, as highlighted by Bahl and Linn in 1992. To achieve a desirable fiscal package, communities should allow residents to choose their jurisdiction, as proposed by Tiebout in 1956. Previous studies have suggested that through fiscal decentralization, developing countries can unlock their economic development potential.

In recent years, there has been a significant body of theoretical and empirical research focusing on the interrelationship between fiscal decentralization, governance, and poverty.

Shah, J.A., Sheikh, M.R., Khan, I.H., Mushtaq, M.I., & Sultan, S. (2025). Fiscal Decentralization, Governance and Poverty Nexus in Pakistan. *Journal of Sustainable and Economic Development*, 3(2), 195-213.
[Received 11 Jan 2025; Accepted 20 Nov 2025; Published 10 Dec 2025]
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This research aims to discern the effects of these variables separately, as well as to understand how they are interconnected simultaneously. The concept of fiscal decentralization plays a crucial role in the study of developing countries, such as Pakistan. It gained substantial recognition after the Second World War as a means to attain global development objectives. Fiscal decentralization serves to further distribute the workload of the central government, particularly in the context of fiscal policy implementation. This approach is closely associated with addressing issues related to fiscal policy enactment. The practice of fiscal decentralization is currently on the rise worldwide as a strategy to enhance the economic stability of various regions across the globe.

Pakistan is one of the countries poised to achieve economic stability through fiscal decentralization. Every country adopts

Table 1. Summary of the Studies on Fiscal Decentralization, Governance and Poverty.

Reference(s)	Time Period	Country	Methodology	Main Results
Digdowiseiso (2022)	1990-2014	53 Developing countries	Pooled OLS	The study revealed a significant negative correlation between revenue decentralization and poverty. In the case of both revenue and expenditure decentralization, there was a substantial negative association with poverty.
Bojanic (2018)	1972-2015	America	Two stages: GLS and GMM	Fiscal decentralization affects participatory government positively.
Kyriacou *et al.* (2017)	1984-2005	Spain	Simultaneous equation model (SEM)	Positive relationship between fiscal decentralization and government quality.
Kyriacou *et al.* (2015)	1984-2006	Spain	Feasible General Least Squares (FGLS) method	Positive, as fiscal decentralization reduced the regional disparities through better institutions of governance.
Ligthart and Oudheusden (2015)	1994-2007	Netherlands	order response model (ORM)	Positive, as fiscal decentralization increased the trust in government.
Golem and Perovic (2014)	1970-2008	Croatia (Split city)	Pooled mean group (PMG) estimation	Negative relationship between fiscal decentralization and the size of government.
Bartolini and Santolini (2013)	1996-2006	Italy	OLS estimator and fixed effect (FE) estimator	Negative relationship between fiscal autonomy and government quality.
Altunbas and Thornton (2012)	1982-2007	UK	OLS estimation	A positive relationship as fiscal decentralization increased the quality of governance.
Enikolopov and Zhuravskaya (2007)	1975-2000	Spain	OLS and SLS Specification	Decentralization positively relates to political institutions and governance.
Rodden (2003)	1978-1997	OECD Countries	ECM	Governance grows faster under fiscal decentralization.
Summary of the Studies on Fiscal Decentralization and Poverty				
Sanogo (2019)	2001-2011		Grouped Fixed Effect (GFE)	Fiscal decentralization is a better tool to reduce poverty
Varlitya *et al.* (2019)	2010-2017	Indonesia	Panel Least Squares (PLS) with Fixed Effects and Robust Least Squares models	Negative and insignificant impact of fiscal decentralization was found on poverty.
Elkhdari and Sarr (2018)	2005-2009	Morocco	Data Envelopment Analysis (DEA)	Decentralized spending improves pro-poor outcomes.
Silas (2018)	2002-2014	Kenya	GMM	Each model found a different effect of fiscal decentralization on poverty, which depends on fiscal decentralization.
Sasana (2018)	2009-2015	Indonesia	GMM	Fiscal decentralization negatively affects poverty.
Sanogo (2017)	2001-2011	France	GFE and ZSLS	Poverty is reduced through local revenue and fiscal decentralization.
Ramirez *et al*. (2016)	2005 census	Colombian	OLS estimation	The revenue collection system should be improved to reduce poverty.
Adhikary (2013)	1983-2010	Nepal	Semi-log linear model, F-statistics	Fiscal decentralization negatively affects poverty.
Maharajabdinul *et al.* (2015)	2005-2013	Indonesia		Insignificant and Negative
Moche et al. (2014)	2005-2011	South Africa	GMM	Fiscal decentralization and poverty are found to be negatively related to each other.

Reference(s)	Time Period	Country	Methodology	Main Results
Faridi and Nazar (2013)	1972-2010	Pakistan	Ordinary least squares (OLS)	Poverty was positively affected by fiscal decentralization.
Kusumaningrum (2013)	1996-2000, 2001-2009	Indonesia	Paired sample test	No clear link, either positive, negative, or no link, may exist
Banwo (2012)	1970-2007	Nigeria	OLS regression	Positive but affected by institutional irregularities
Faridi *et al.* (2012)	1972-2009	Pakistan	OLS	The positive effect of fiscal decentralization on employment which reduces poverty.
Sepulueda *et al.* (2011)	1971-2000	USA	GLS estimation	Negative and significant
Nguyen (2008)	2002 and 2004	Vietnam	Statistical model	Fiscal decentralization negatively affected poverty.
Yao (2007)	1975-2000	99 countries data	Panel GMM	A non-linear and significant relationship was found between poverty and fiscal decentralization.
Summary of the Studies on Fiscal Decentralization and Economic Growth				
Song et al (2022)	2010 to 2018	24 provinces	Spatial Dobbin model	Fiscal revenue decentralization has a substantial inhibitory effect on poverty reduction, and fiscal expenditure decentralization has an important promoting influence on poverty reduction.
Baskaran *et al.* (2016)		Germany	Meta-Regression model and OLS estimation	Positive in the case of a single county, but the cross-country relationship is difficult to identify.
Asatryan and Feld (2015)	1975-2000		Bayesian model averaging	Significant but positive or negative in the case of fiscal decentralization and economic growth, but no link between fiscal decentralization and output.
Hanif and Chaudhry (2015)	1972-2013	Pakistan	Johansen co-integration procedure	Fiscal decentralization was significantly and positively related to economic growth.
Shahid and Ali (2015)	1972-2012	Pakistan	ARDL	Negative relationship between expenditure decentralization and economic growth.
Udoh *et al.* (2015)	1980-2012	Nigeria	Auto Regressive Distributed Lag (ARDL)	Negative relation as fiscal decentralization increased the cost of governance.
Hanif *et al.* (2014)	1972-2010	Pakisatn	OLS, Augmented Dickey Fuller test	Fiscal decentralization affected economic growth positively.
Gemmell *et al.* (2013)	1972-2005		PMG estimation	Negative relationship between spending decentralization and economic growth, but a positive relationship between revenue decentralization and economic growth.
Iqbal *et al.* (2012)	1972-2010	Pakistan	GMM estimation (OLS and ADF) test	Positive link between revenue decentralization and economic growth, but a negative with expenditure decentralization and economic growth
Philip and Isha (2012)	1970-2009	Nigeria	OLS and Unit root test with the Augmented Dickey Fuller test	There exists a positive impact of fiscal decentralization on economic growth.
Pose and Ezcurra (2011)	1990-2005	UK	OLS estimation	Economic growth was found to be negatively but significantly affected by fiscal decentralization.
Pose and Kroijer (2009)	1990-2004	UK		Fiscal decentralization affected economic growth negatively.

different strategies based on its economic conditions. Both developing and developed nations are pursuing decentralization to enhance their economic performance. The citizens of these nations are acutely aware of the high cost of poor management. Developing countries like Pakistan grapple with dire poverty conditions due to the lack of

necessities such as food, shelter, and clothing. Sixty percent of Pakistan's population lives below the poverty line, as defined by the regulatory authorities of the country. The primary reason behind this poverty in developing countries like Pakistan can be attributed to poor management, the misallocation of resources, inefficient production techniques, a low literacy rate, and misguided administrative practices, all contributing to problematic outcomes.

Fiscal decentralization offers a potential solution to the issues of poor governance and inadequate management. It can help address the problems associated with poverty and ensure the provision of necessities such as food, shelter, and clothing, ultimately raising the overall standard of living for the entire nation and promoting more equitable wealth distribution. Consequently, the eradication of poverty can be effectively achieved through sound governance, which can be facilitated by fiscal decentralization.

This study has concentrated on the highly significant field of public finance. Fiscal decentralization has emerged as a crucial concern for developing countries. The primary objectives of this study are as follows:

- To examine the influence of fiscal decentralization on poverty.
- To investigate the connection between fiscal decentralization and governance.

The remainder of the paper is structured as follows: Section 2 presents a literature review of empirical studies. Section 3 elaborates on the model, data, and methodology used. Section 4 discusses the results, and Section 5 concludes this study, accompanied by policy implications.

***Review of Empirical Literature*:** This section contains the empirical review of summary of the studies on fiscal decentralization, governance, and poverty. Table 1 displays a summary of the studies.

After reviewing several previous studies on fiscal decentralization and governance, we have observed that many of these studies employ OLS estimation using data from developed countries. Most of them have found a positive impact of fiscal decentralization on governance in these contexts. Conversely, much of the existing literature also examines developing countries, using OLS estimation, and many of these studies have highlighted a negative impact of fiscal decentralization on poverty. This study aims to describe the impact of fiscal decentralization on governance and poverty in Pakistan. The study is based on six types of fiscal decentralization, which are categorized into two sections: adjusted and unadjusted fiscal decentralization. Within each section, fiscal decentralization is further divided into three sub-sections, encompassing revenue, expenditure, and combined decentralization. This study presents six models, each focusing on a specific type of decentralization, while considering various other variables, including their interaction with the governance index.

We have also included trade and the broad money supply (M2) as independent variables, as these were not utilized in previous studies. In contrast, we employ ARDL estimation to elucidate the effects of fiscal decentralization on governance and poverty, which has not been explored in any prior studies on fiscal decentralization. Upon a thorough review of numerous studies investigating the influence of fiscal decentralization on governance and poverty, we have observed that none of these studies have successfully demonstrated the effects of fiscal decentralization on both governance and poverty in a single study. The existing body of literature primarily focuses on either the impact of fiscal decentralization on governance or its effects on poverty.

MATERIALS AND METHODS

***Model Specification*:** In this section, the relationship between fiscal decentralization, governance, and poverty is presented in model form. The analysis is divided into two groups. The first group examines unadjusted decentralization—revenue decentralization (RD), expenditure decentralization (ED), and composite decentralization (CD)—in relation to the poverty headcount ratio (PHCR). The second group focuses on adjusted decentralization—adjusted revenue decentralization (ARD), adjusted expenditure decentralization (AED), and adjusted composite decentralization (ACD)—and their relationship with the poverty headcount ratio (PHCR).

***Unadjusted Decentralization and Poverty (PHCR)*:** Unadjusted decentralization models are further divided into three sub-parts: revenue decentralization, expenditure decentralization, and combined decentralization.

Model 1. Unadjusted Revenue Decentralization, Governance and Poverty

$$PHCR = \lambda_0 + \lambda_1 RD + \lambda_2 GI + \lambda_3 (RD * GI) + \lambda_4 GDPG + \lambda_5 GINI + \lambda_6 CREDIT + \lambda_7 TRADE + \lambda_8 M_2 + \varepsilon \quad \textbf{(1)}$$

Model 2. Unadjusted Expenditure Decentralization, Governance and Poverty

$$PHCR = \lambda_0 + \lambda_1 ED + \lambda_2 GI + \lambda_3 (ED * GI) + \lambda_4 GDPG + \lambda_5 GINI + \lambda_6 CREDIT + \lambda_7 TRADE + \lambda_8 M_2 + \varepsilon \quad \textbf{(2)}$$

Model 3. Unadjusted Combined Decentralization, Governance and Poverty

$$PHCR = \lambda_0 + \lambda_1 CD + \lambda_2 GI + \lambda_3 (CD * GI) + \lambda_4 GDPG + \lambda_5 GINI + \lambda_6 CREDIT + \lambda_7 TRADE + \lambda_8 M_2 + \varepsilon \quad \textbf{(3)}$$

***Adjusted Decentralization and Poverty (PHCR)*:** Adjusted decentralization models are also further divided into three sub-parts: adjusted revenue decentralization, adjusted expenditure decentralization, and adjusted combined decentralization.

Model 4: Adjusted Revenue Decentralization, Governance and Poverty

$$PHCR = \lambda_0 + \lambda_1 ARD + \lambda_2 GI + \lambda_3 (ARD * GI) + \lambda_4 GDPG + \lambda_5 GINI + \lambda_6 CREDIT + \lambda_7 TRADE + \lambda_8 M_2 + \varepsilon \quad \textbf{(4)}$$

Model 5: Adjusted Expenditure Decentralization, Governance and Poverty $PHCR = \lambda_0 + \lambda_1 AED + \lambda_2 GI + \lambda_3 (AED * GI) + \lambda_4 GDPG + \lambda_5 GINI + \lambda_6 CREDIT + \lambda_7 TRADE + \lambda_8 M_2 + \varepsilon$ **(5)**

Model 6: Adjusted Combined Decentralization, Governance and Poverty

$PHCR = \lambda_0 + \lambda_1 ACD + \lambda_2 GI + \lambda_3 (ACD * GI) + \lambda_4 GDPG + \lambda_5 GINI + \lambda_6 CREDIT + \lambda_7 TRADE + \lambda_8 M_2 + \varepsilon$ **(6)**

Where: RD = Revenue Decentralization, ED = Expenditure Decentralization, CD = Combined Decentralization, ARD = Adjusted Revenue Decentralization, AED = Adjusted Expenditure Decentralization, ACD = Adjusted Combined Decentralization, GI = Governance Index, RD*GI = Interaction Term of RD and GI, ED*GI = Interaction Term, CD*GI = Interaction Term, ARD*GI = Interaction Term, AED*GI = Interaction Term, ACD*GI = Interaction Term, GDPG = GDP Growth Rate (annual %), GINI = GINI Index, CREDIT = Domestic Credit to Private Sector (% of GDP), TRADE = Trade (% of GDP), M_2 = Broad Money Supply (% of GDP)

***Data: Sources and Description*:** The study uses annual time series data of all the variables collected from different sources for the period of 1996-2022. The secondary data of all types of decentralization is collected from "Handbook of Statistics on Pakistan Economy (2020)". While the data of GDPG, GINI, CREDIT, M_2 and TRADE were acquired from "World Development Indicators (WDI)". The data on Governance are collected from "World Governance Indicators (WGI)"

***Description of Variables*:**

The descriptions of the variables that are used in the models are given as follows.

***Revenue Decentralization (RD)*:** "Provincial government revenue divided by the sum of provincial government and federal government revenue is called revenue decentralization".

It could be calculated through this formula.

$$\text{Rev Dec} = \frac{\text{PG Rev}}{\text{PG Rev} + \text{FG Rev}}$$

***Expenditure Decentralization (ED)*:** "Provincial government expenditures divided by the sum of provincial government and federal government expenditures is called expenditure decentralization".

It could be calculated through this formula.

$$\text{ExpDev} = \frac{\text{PGExp}}{\text{PGExp} + \text{FGExp}}$$

***Combined Decentralization (CD)*:** "Combined decentralization is the revenue decentralization divided by one minus expenditures decentralization".

It could be calculated through this formula.

$$\text{CDec} = \frac{\text{RDec}}{1 - \text{EDec}}$$

***Adjusted Revenue Decentralization (ARD)*:** "Adjusted revenue decentralization is the provincial government revenue divided by the sum of provincial government revenue and federal government revenue subtracting federal government's grants and aid".

It could be calculated through this formula.

$$\text{Rev Dec} = \frac{\text{PG Rev}}{\text{PG Rev} + \text{FG Rev} - (\text{G} + \text{A})}$$

***Adjusted Expenditure Decentralization (AED)*:** "Adjusted expenditures decentralization is the provincial government expenditures divided by the sum of provincial government expenditures and federal government expenditures subtracting federal government's defense expenditure and interest payments".

It could be calculated through this formula.

$$\text{ExpDev} = \frac{\text{PExp}}{\text{PExp} + \text{FExp} - (\text{DExp} + \text{IExp})}$$

***Adjusted Combined Decentralization (ACD)*:** "Adjusted combined decentralization is the revenue decentralization divided by one minus expenditures decentralization subtracting federal government's grants, aid, defense expenditures and interest payments".

$$\text{ACDec} = \frac{\text{RDec}}{1\text{-EDec-(G+A+DExp+IExp)}}$$

***World Governance Index (GI)*:** "The public sector management and institutions cluster includes property rights and rule-based governance, quality of budgetary and financial management, efficiency of revenue mobilization, quality of public administration, and transparency, accountability, and corruption in the public sector".

***GDP Growth (annual %)*:** "Annual percentage growth rate of GDP at market prices based on current local currency".

***GINI Index (GINI)*:** "GINI index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution".

***Domestic Credit to Private Sector (% of GDP)*:** "Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment".

***Trade (% of GDP)*:** "Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product (World Bank national accounts data, and OECD National Accounts data files)".

***Broad Money Supply (% of GDP)*:** "Broad Money Supply (M_2) is the sum of currency outside banks: demand deposits other than those of the central Govt, the foreign currency, saving and time deposits of resident sectors other than the central Government; travelers check and bank; and other securities such as commercial papers and certificate of deposit (WDI, 2018)".

Methodology: ARDL technique has been applied. ARDL model specifications of this study are given as:

Model 1. Unadjusted Revenue Decentralization, Governance and Poverty

The general form equation of model 1 is

$$\Delta(PHCR)_t = \alpha + \beta_1(RD)_{t-1} + \beta_2(GI)_{t-1} + \beta_3(RD * GI)_{t-1} + \beta_4(GDPG)_{t-1} + \beta_5(GINI)_{t-1} + \beta_6(CREDIT)_{t-1} + \beta_7(TRADE)_{t-1} + \beta_8(M_2)_{t-1} + \sum_{i=1}^{a_1} \delta_1 \Delta(PHCR)_{t-i} + \sum_{i=0}^{a_2} \delta_2 \Delta(RD)_{t-i} + \sum_{i=0}^{a_3} \delta_3 \Delta(GI)_{t-i} + \sum_{i=0}^{a_4} \delta_4 \Delta(RD * GI)_{t-i} + \sum_{i=0}^{a_5} \delta_5 \Delta(GDPG)_{t-i} + \sum_{i=0}^{a_6} \delta_6 \Delta(GINI)_{t-i} + \sum_{i=0}^{a_7} \delta_7 \Delta(CREDIT)_{t-i} + \sum_{i=0}^{a_8} \delta_8 \Delta(TRADE)_{t-i} + \sum_{i=0}^{a_9} \delta_9 \Delta(M_2)_{t-i} + \varepsilon_t \quad \textbf{(7)}$$

Model 2. Unadjusted Expenditure Decentralization, Governance and Poverty

The general form equation of model 2 is

$$\Delta(PHCR)_t = \alpha + \beta_1(ED)_{t-1} + \beta_2(GI)_{t-1} + \beta_3(ED * GI)_{t-1} + \beta_4(GDPG)_{t-1} + \beta_5(GINI)_{t-1} + \beta_6(CREDIT)_{t-1} + \beta_7(TRADE)_{t-1} + \beta_8(M_2)_{t-1} + \sum_{i=1}^{a_1} \delta_1 \Delta(PHCR)_{t-i} + \sum_{i=0}^{a_2} \delta_2 \Delta(ED)_{t-i} + \sum_{i=0}^{a_3} \delta_3 \Delta(GI)_{t-i} + \sum_{i=0}^{a_4} \delta_4 \Delta(ED * GI)_{t-i} + \sum_{i=0}^{a_5} \delta_5 \Delta(GDPG)_{t-i} + \sum_{i=0}^{a_6} \delta_6 \Delta(GINI)_{t-i} + \sum_{i=0}^{a_7} \delta_7 \Delta(CREDIT)_{t-i} + \sum_{i=0}^{a_8} \delta_8 \Delta(TRADE)_{t-i} + \sum_{i=0}^{a_9} \delta_9 \Delta(M_2)_{t-i} + \varepsilon_t \quad \textbf{(8)}$$

Model 3. Unadjusted Combined Decentralization, Governance and Poverty

The general form equation of model 3 is

$$\Delta(PHCR)_t = \alpha + \beta_1(CD)_{t-1} + \beta_2(GI)_{t-1} + \beta_3(CD * GI)_{t-1} + \beta_4(GDPG)_{t-1} + \beta_5(GINI)_{t-1} + \beta_6(CREDIT)_{t-1} + \beta_7(TRADE)_{t-1} + \beta_8(M_2)_{t-1} + \sum_{i=1}^{a_1} \delta_1 \Delta(PHCR)_{t-i} + \sum_{i=0}^{a_2} \delta_2 \Delta(CD)_{t-i} + \sum_{i=0}^{a_3} \delta_3 \Delta(GI)_{t-i} + \sum_{i=0}^{a_4} \delta_4 \Delta(CD * GI)_{t-i} + \sum_{i=0}^{a_5} \delta_5 \Delta(GDPG)_{t-i} + \sum_{i=0}^{a_6} \delta_6 \Delta(GINI)_{t-i} + \sum_{i=0}^{a_7} \delta_7 \Delta(CREDIT)_{t-i} + \sum_{i=0}^{a_8} \delta_8 \Delta(TRADE)_{t-i} + \sum_{i=0}^{a_9} \delta_9 \Delta(M_2)_{t-i} + \varepsilon_t \quad \textbf{(9)}$$

Model 4. Adjusted Revenue Decentralization, Governance and Poverty

The general form equation of model 4 is

$$\Delta(PHCR)_t = \alpha + \beta_1(ARD)_{t-1} + \beta_2(GI)_{t-1} + \beta_3(ARD * GI)_{t-1} + \beta_4(GDPG)_{t-1} + \beta_5(GINI)_{t-1} + \beta_6(CREDIT)_{t-1} + \beta_7(TRADE)_{t-1} + \beta_8(M_2)_{t-1} + \sum_{i=1}^{a_1} \delta_1 \Delta(PHCR)_{t-i} + \sum_{i=0}^{a_2} \delta_2 \Delta(ARD)_{t-i} + \sum_{i=0}^{a_3} \delta_3 \Delta(GI)_{t-i} + \sum_{i=0}^{a_4} \delta_4 \Delta(ARD * GI)_{t-i} + \sum_{i=0}^{a_5} \delta_5 \Delta(GDPG)_{t-i} + \sum_{i=0}^{a_6} \delta_6 \Delta(GINI)_{t-i} + \sum_{i=0}^{a_7} \delta_7 \Delta(CREDIT)_{t-i} + \sum_{i=0}^{a_8} \delta_8 \Delta(TRADE)_{t-i} + \sum_{i=0}^{a_9} \delta_9 \Delta(M_2)_{t-i} + \varepsilon_t \quad \textbf{(10)}$$

Model 5. Adjusted Expenditure Decentralization, Governance and Poverty

The general form equation of model 5 is

$$\Delta(PHCR)_t = \alpha + \beta_1(AED)_{t-1} + \beta_2(GI)_{t-1} + \beta_3(AED * GI)_{t-1} + \beta_4(GDPG)_{t-1} + \beta_5(GINI)_{t-1} + \beta_6(CREDIT)_{t-1} + \beta_7(TRADE)_{t-1} + \beta_8(M_2)_{t-1} + \sum_{i=1}^{a_1} \delta_1 \Delta(PHCR)_{t-i} + \sum_{i=0}^{a_2} \delta_2 \Delta(AED)_{t-i} + \sum_{i=0}^{a_3} \delta_3 \Delta(GI)_{t-i} + \sum_{i=0}^{a_4} \delta_4 \Delta(AED * GI)_{t-i} + \sum_{i=0}^{a_5} \delta_5 \Delta(GDPG)_{t-i} + \sum_{i=0}^{a_6} \delta_6 \Delta(GINI)_{t-i} + \sum_{i=0}^{a_7} \delta_7 \Delta(CREDIT)_{t-i} + \sum_{i=0}^{a_8} \delta_8 \Delta(TRADE)_{t-i} + \sum_{i=0}^{a_9} \delta_9 \Delta(M_2)_{t-i} + \varepsilon_t \quad \textbf{(11)}$$

Model 6. Adjusted Combined Decentralization, Governance and Poverty

The general form equation of model 6 is

$$\Delta(PHCR)_t = \alpha + \beta_1(ACD)_{t-1} + \beta_2(GI)_{t-1} + \beta_3(ACD * GI)_{t-1} + \beta_4(GDPG)_{t-1} + \beta_5(GINI)_{t-1} + \beta_6(CREDIT)_{t-1}$$

$$+\beta_7(TRADE)_{t-1} + \beta_8(M_2)_{t-1} + \sum_{i=1}^{a_1} \delta_1 \Delta\,(PHCR)_{t-i} + \sum_{i=0}^{a_2} \delta_2\,\Delta(ACD)_{t-i} + \sum_{i=0}^{a_3} \delta_3 \Delta\,(GI)_{t-i} + \sum_{i=0}^{a_4} \delta_4 \Delta\,(ACD * GI)_{t-i} + \sum_{i=0}^{a_5} \delta_5 \Delta\,(GDPG)_{t-i} + \sum_{i=0}^{a_6} \delta_6 \Delta\,(GINI)_{t-i} + \sum_{i=0}^{a_7} \delta_7 \Delta\,(CREDIT)_{t-i} + \sum_{i=0}^{a_8} \delta_8 \Delta\,(TRADE)_{t-i} + \sum_{i=0}^{a_9} \delta_9 \Delta\,(M_2)_{t-i} + \varepsilon_t \quad \textbf{(12)}$$

RESULTS AND DISCUSSIONS

***Descriptive Statistics and Correlation Analysis*:** Table 2 presents the descriptive statistics of the key variables. The mean value of revenue decentralization (RD) is 33.24, while the median is 38.71. Since the median exceeds the mean, RD exhibits negative skewness, which is confirmed by the skewness value of −1.32, indicating a left-tailed distribution rather than a normal distribution. The maximum value of RD is 44.68, representing its highest observed level, whereas the minimum value is 5.97, reflecting its lowest level during the study period.

The standard deviation of RD is 13.36, indicating a moderate dispersion of RD around its mean. The kurtosis value of RD is 3.18, which exceeds the benchmark value of three, suggesting a leptokurtic distribution with a higher peak than the normal distribution. The Jarque–Bera statistic for RD is 6.42, and the associated probability value of 0.04 indicates that RD deviates from normality at the 5 percent significance level.

The mean value of expenditure decentralization (ED) is 26.56, which is slightly higher than its median value of 26.40. This indicates that ED is positively skewed, as also confirmed by the skewness value of 0.51, showing a right-tailed distribution. The maximum value of ED is 31.84, while the minimum is 22.33. These values, along with a low standard deviation of 2.87, indicate low dispersion in ED compared to RD. The kurtosis value of 2.24 is less than three, suggesting a platykurtic and flatter distribution. The Jarque–Bera statistic of 1.47 is statistically insignificant, indicating that ED is normally distributed.

The mean value of composite decentralization (CD) is −128.05, while the median is −143.13. Since the mean is greater than the median, CD is positively skewed, with a skewness value of 1.38. The maximum and minimum values of CD are −26.44 and −177.39, respectively, indicating high variation. This is supported by a large standard deviation of 48.93. The kurtosis value of 3.37 shows a leptokurtic distribution. The Jarque–Bera statistic of 7.08 is statistically significant, indicating that CD is not normally distributed.

The mean value of adjusted revenue decentralization (ARD) is 4.09, and the median is 3.78. As the mean exceeds the median, ARD is positively skewed with a skewness value of 0.43. The maximum and minimum values are 40.45 and −25.88, respectively. The standard deviation of 18.48 indicates moderate dispersion. The kurtosis value of 2.59 suggests a platykurtic distribution. The Jarque–Bera statistic of 0.82 is statistically insignificant, indicating normal distribution.

The mean value of adjusted expenditure decentralization (AED) is 42.27, while the median is 46.69. Since the median is higher than the mean, AED is negatively skewed, as reflected by a skewness value of −2.91. The maximum and minimum values are 62.55 and −46.55, respectively, showing wide variation. The standard deviation is 22.31, indicating high dispersion. The kurtosis value of 12.48 suggests a highly leptokurtic distribution. The Jarque–Bera statistic of 113.51 is highly significant, indicating that AED is not normally distributed.

The mean value of adjusted composite decentralization (ACD) is −10.10, and the median is −6.88. The higher median indicates negative skewness, with a skewness value of −0.62. The maximum and minimum values are 51.84 and −91.35, respectively. A standard deviation of 39.80 shows considerable dispersion. The kurtosis value of 2.76 suggests a

Table 2. Descriptive Statistics of Key Variables (1996-2022).

	Mean	Median	Max	Min	S.D	Skew.	Kurt.	JB	Prob.
RD	33.24	38.71	44.68	5.97	13.36	-1.32	3.18	6.42	0.04
ED	26.56	26.40	31.84	22.33	2.87	0.51	2.24	1.47	0.48
CD	-128.05	-143.13	-26.44	-177.39	48.93	1.38	3.37	7.08	0.03
ARD	4.09	3.78	40.45	-25.88	18.84	0.43	2.59	0.82	0.66
AED	42.27	46.69	62.55	-46.25	22.31	-2.91	12.48	113.51	0.00
ACD	-10.10	-6.88	51.84	-91.35	39.80	-0.62	2.76	1.45	0.48
GI	0.45	0.46	0.55	0.36	0.05	0.06	2.37	0.38	0.83
GDPG	4.07	4.31	7.67	1.01	1.79	0.21	2.45	0.44	0.80
GINI	0.43	0.43	0.43	0.42	0.00	-0.20	1.71	1.67	0.43
CREDIT	22.25	22.48	28.74	15.31	4.66	-0.17	1.69	1.68	0.43
TRADE	33.06	32.86	38.33	28.13	2.31	0.25	3.22	0.27	0.87
M2	42.66	42.20	49.19	36.71	4.09	0.11	1.60	1.83	0.40
PHCR	25.23	23.93	34.60	21.43	3.44	1.51	4.24	9.76	0.01

platykurtic distribution. The Jarque–Bera statistic of 1.45 is statistically insignificant, indicating normal distribution.

The mean and median values of governance index (GI) are almost equal at 0.45 and 0.46, respectively, indicating near-normal distribution. The skewness value of 0.06 shows symmetry in the distribution. The maximum and minimum values are 0.55 and 0.35, respectively. The standard deviation is very low at 0.05, indicating minimal variation. The kurtosis value of 2.37 suggests a platykurtic distribution. The Jarque–Bera statistic of 0.38 is statistically insignificant, confirming normality.

The mean value of GDP growth (GDPG) is 4.07, while the median is 4.31. Although the median is slightly higher, the positive skewness value of 0.21 indicates a right-tailed distribution. The maximum and minimum values are 7.67 and 1.01, respectively. A standard deviation of 1.79 indicates low dispersion. The kurtosis value of 2.45 suggests a flatter distribution. The Jarque–Bera statistic of 0.44 is statistically insignificant, indicating normal distribution.

The mean and median values of the Gini index are both 0.43, indicating a nearly symmetric distribution. The skewness value of −0.20 shows slight negative skewness. The maximum and minimum values are almost identical, resulting in a near-zero standard deviation. The kurtosis value of 1.71 indicates a platykurtic distribution. The Jarque–Bera statistic of 1.67 is statistically insignificant, suggesting normality.

The mean value of credit is 22.25, while the median is 22.48. Since the median is higher, credit is slightly negatively skewed with a skewness value of −0.17. The maximum and minimum values are 28.74 and 15.31, respectively. A standard deviation of 4.66 indicates low dispersion. The kurtosis value of 1.69 suggests a flatter distribution. The Jarque–Bera statistic of 1.68 is statistically insignificant, indicating normal distribution.

The mean value of trade is 33.06, and the median is 32.86. As the mean is higher than the median, trade is positively skewed with a skewness value of 0.25. The maximum and minimum values are 38.33 and 28.13, respectively. The standard deviation of 2.31 indicates moderate dispersion. The kurtosis value of 3.22 suggests a leptokurtic distribution. The Jarque–Bera statistic of 0.27 is statistically insignificant, indicating normality.

The mean value of broad money (M2) is 44.66, while the median is 42.20. The positive skewness value of 0.11 indicates a right-tailed distribution. The maximum and minimum values are 49.19 and 36.71, respectively. The standard deviation of 4.09 indicates moderate dispersion. The kurtosis value of 1.60 suggests a platykurtic distribution. The Jarque–Bera statistic of 1.83 is statistically insignificant, indicating normal distribution.

The mean value of the poverty headcount ratio (PHCR) is 25.23, while the median is 23.93. Since the mean exceeds the median, PHCR is positively skewed, with a skewness value of 1.51. The maximum and minimum values are 34.60 and 21.43, respectively. The standard deviation of 3.44 indicates moderate dispersion. The kurtosis value of 4.24 shows a leptokurtic distribution. The Jarque–Bera statistic of 9.76 is statistically significant, indicating that PHCR is not normally distributed.

Table 3 presents the correlation analysis. A correlation is considered weak when the coefficient lies between 0.00 and 0.29, moderate when it ranges from 0.30 to 0.69, and strong when it falls between 0.70 and 1.00. The table includes thirteen variables: PHCR, RD, ED, CD, ARD, AED, ACD, GI, GDPG, GINI, CREDIT, TRADE, and M2.

PHCR shows weak correlation with RD, ED, CD, GI, CREDIT, TRADE, and M2. It has a moderate correlation with AED, ACD, and GDPG, while a strong correlation is observed with ARD and GINI. Most variables are negatively correlated with PHCR.

RD is strongly correlated only with CD. It shows moderate correlation with ED, AED, GI, GINI, CREDIT, and M2, while ARD, ACD, GDPG, and TRADE are weakly correlated with RD. ED is moderately correlated with CD, AED, GI, GDPG, CREDIT, and M2. It has weak correlation with ARD, ACD, GINI, and TRADE. No strong correlation is observed between ED and any variable.

Table 3: Correlation Matrix of Key Variables (1996-2022)

	PHCR	RD	ED	CD	ARD	AED	ACD	GI	GDPG	GINI	CREDIT	TRADE	M2
PHCR	1.00												
RD	0.21	1.00											
ED	-0.07	0.62	1.00										
CD	-0.27	-0.96	-0.38	1.00									
ARD	-0.72	0.18	0.24	-0.12	1.00								
AED	0.33	0.65	0.53	-0.58	-0.11	1.00							
ACD	0.66	-0.25	-0.24	0.20	-0.98	0.01	1.00						
GI	-0.24	-0.35	-0.65	0.18	-0.14	-0.32	0.14	1.00					
GDPG	-0.30	0.29	0.55	-0.15	0.24	0.27	-0.26	-0.23	1.00				
GINI	-0.72	-0.46	-0.24	0.46	0.50	-0.44	-0.49	0.32	0.33	1.00			
CREDIT	0.13	0.64	0.68	-0.51	0.20	0.40	-0.17	-0.51	0.11	-0.56	1.00		
TRADE	-0.26	0.08	0.13	-0.04	0.09	0.12	-0.09	0.45	-0.04	0.00	0.28	1.00	
M2	0.11	0.48	0.58	-0.35	-0.01	0.40	0.02	-0.35	0.19	-0.49	0.83	0.42	1.00

CD is weakly correlated with ARD, ACD, GI, GDPG, and TRADE, and moderately correlated with AED, GINI, CREDIT, and M2. No strong correlation exists between CD and other variables. ARD shows weak correlation with most variables, including AED, GI, GDPG, CREDIT, TRADE, and M2. It has a moderate correlation with GINI and a strong correlation with ACD. AED is moderately correlated with GI, GINI, CREDIT, and M2, while weak correlations are observed with ACD, GDPG, and TRADE. No strong correlation is found for AED. ACD is weakly correlated with GI, GDPG, CREDIT, TRADE, and M2, and moderately correlated with GINI. No strong correlation exists for ACD. GI is moderately correlated with GINI, CREDIT, TRADE, and M2, while GDPG shows a weak correlation with GI. No strong correlation is observed for GI.

GDPG is weakly correlated with CREDIT, TRADE, and M2, and moderately correlated with GINI. It does not show strong correlation with any variable. GINI has moderate correlation with CREDIT and M2, while it shows very weak correlation with TRADE. CREDIT is weakly correlated with TRADE but strongly correlated with M2. TRADE shows a moderate correlation with M2.

***Unit Root Analysis*:** A unit root test is employed to ascertain whether the variables are stationary or non-stationary. Stationarity is assessed in two stages: "stationary at the level" (I (0)) or "stationary at the first difference" (I (1)). The Augmented Dickey-Fuller (ADF) test is utilized to assess the stationarity of the variables in this study. It also aids in determining the most suitable econometric technique for examining long-term results. If all variables are stationary at the level (I (0)), ordinary least squares (OLS) is employed to estimate long-term results. When all variables are stationary at the first difference (I (1)), Granger causality or Johansen cointegration is used to examine long-term results. If some variables are stationary at the first difference (I (1)) while others are stationary at the level (I (0)), the Autoregressive Distributed Lag (ARDL) approach is utilized to derive long-term results. The ADF test is applied to verify the stationarity of the variables, whether they are stationary or non-stationary.

The probability value of ACD at intercept and intercept and trend is 0.3745 and 0.6130 respectively, which is non-stationary. The probability value of none is 0.085 which is stationary. It is non-stationary at intercept and intercept and trend and only stationary at none. ACD is non-stationary at first difference I (1) and we accept null hypothesis of "a series has unit root (non-stationary)". The probability value of AED at intercept is 0.0130 and at intercept and trend is 0.0079 which are stationary and only non-stationary at none which is 0.207. AED is stationary at level I (0) and we reject null hypothesis as series has no unit root (Stationary).

The probability value if ARD is non-stationary at all three stages of ADF. Intercept is 0.5681, intercept and trend is 0.8461 and none is 0.1699. ARD is non-stationary at first difference I (1) and we accept null hypothesis. The probability value of CD at intercept and none are 0.2908 and 0.3476 which are non-stationary and intercept and trend is 0.0293 which is stationary. CD is non-stationary at first difference I (1) and we accept null hypothesis.

CREDIT is non-stationary at first difference I (1) as its intercept is 0.8087, intercept and trend is 0.6212 and none is 0.3015. Probability value of all three stages are greater than 0.10, we accept the null hypothesis of "a series has unit root (non-stationary)". The intercept, intercept and trend and none of ED are non-stationary at first difference I (1) as their probability values are 0.1531, 0.2626 and 0.5093 respectively. We accept the null hypothesis a series has unit root (non-stationary). The probability values of GDPG at intercept, intercept and trend and none are 0.2015, 0.404 and 0.3374 respectively. All three stages are non-stationary as their probability values are greater than 0.10. We accept the null hypothesis as GDPG is non-stationary at first difference I (1).

The intercept of GI is 0.5127, intercept and trend is 0.5728 and none is 0.6745. All three stages of GI are non-stationary at first difference I (1) as their probability values is greater than 0.10. We accept the null hypothesis as series has unit root (non-stationary).

The intercept and none of GINI are non-stationary as their probability values are 0.9135 and 0.9503. Intercept and trend is 0.0674 which is stationary. As two stages of ADF are non-stationary, the GINI is non-stationary at first difference I (1). As series has unit root (non-stationary) we accept the null hypothesis.

The probability of M_2 at intercept is 0.5737, intercept and trend is 0.5079 and none is 0.3395. All three stages of M_2 are non-stationary as their probability values are greater than 0.10. M_2 is non-stationary at first difference I (1), we accept the null hypothesis. The probability value of TRADE at intercept is stationary, which is 0.0217. Intercept and trend and none are non-stationary, which are 0.1116 and 0.4234 and greater than 0.10. We accept the null hypothesis of series has unit root (non-stationary) as TRADE is non-stationary at first difference I (1). The intercept and none of RD are non-stationary and their probability values are 0.3605 and 0.3192. The intercept and trend is stationary and its probability value is 0.0740. RD is non-stationary at first difference I (1). As series has unit root (non-stationary) we accept the null hypothesis. The probability of PHCR at intercept is 0.6928, intercept and trend is 0.5324 and none is 0.4784. All three stages of ADF are non-stationary as probability values of all stages are greater than 0.10. We accept the null hypothesis as the series has unit root (non-stationary) and PHCR is non-stationary at first difference I (1).

***ARDL Bounds Analysis*:** ARDL bounds analysis shows that there exists a long-run relationship in the model are not. If the value of the F-statistic is greater than the upper bound at both the 5% and 10% level of significance, it means there exists a long-run relationship in the model.

Table 4. ADF Test.

Variable	Intercept	Lag	Intercept and trend	Lag	None	Lag	Conclusion
ACD	-1.790445	0	-1.911582	0	-1.69070	0	I(1)
	(0.3745)		(0.6130)		(0.0855)		
AED	-3.665424	0	-4.581490	0	-1.175322	1	I(0)
	(0.0130)		(0.0079)		(0.2107)		
ARD	-1.388379	0	-1.348115	0	-1.309195	0	I(1)
	(0.5681)		(0.8461)		(0.1699)		
CD	-1.984216	0	-3.988352	3	-0.822498	0	I(1)
	(0.2908)		(0.0293)		(0.3476)		
CREDIT	-0.763658	0	-1.891752	1	-0.931720	0	I(1)
	(0.8087)		(0.6212)		(0.3015)		
ED	-2.401820	0	-2.654714	0	-0.445510	0	I(1)
	(0.1531)		(0.2626)		(0.5093)		
GDPG	-2.232567	0	-2.317773	0	-0.842778	0	I(1)
	(0.2015)		(0.4074)		(0.3374)		
GI	-1.498419	2	-1.974927	4	0.013083	2	I(1)
	(0.5127)		(0.5728)		(0.6745)		
GINI	-0.274056	0	-4.493638	1	1.351170	0	I(1)
	(0.9135)		(0.0674)		(0.9503)		
M2	-1.376583	0	-2.116295	0	-0.841217	0	I(1)
	(0.5737)		(0.5079)		(0.3395)		
TRADE	-3.423394	0	-3.197853	0	-0.648626	1	I(1)
	(0.0217)		(0.1116)		(0.4234)		
RD	-0.821409	0	-3.465712	3	-0.889128	0	I(1)
	(0.3605)		(0.0740)		(0.3192)		
PHCR	-1.107332	0	-2.068679	0	-0.521930	0	I(1)
	(0.6928)		(0.5324)		(0.4784)		

Table 5. Results of F-Test.

		5% critical value		10% critical value	
Models	**F- statistic**	**I(0)**	**I(1)**	**I(0)**	**I(1)**
PHCR/ **RD**, GI, RD*GI, GDPG, GINI, CREDIT, TRADE, M2	3.53	2.32	3.50	2.03	3.13
PHCR/ **ED**, GI, ED*GI, GDPG, GINI, CREDIT, TRADE, M2	3.82	2.32	3.50	2.03	3.13
PHCR/ **CD**, GI, CD*GI, GDPG, GINI, CREDIT, TRADE, M2	3.63	2.32	3.50	2.03	3.13
PHCR/ **ARD**, GI, ARD*GI, GDPG, GINI, CREDIT, TRADE, M2	3.52	2.32	3.50	2.03	3.13
PHCR/ **AED**, GI, AED*GI, GDPG, GINI, CREDIT, TRADE, M2	3.64	2.32	3.50	2.03	3.13
PHCR/ **ACD**, GI, ACD*GI, GDPG, GINI, CREDIT, TRADE, M2	4.01	2.32	3.50	2.03	3.13

Before estimating the long-run results, it is necessary to test whether a long-run relationship exists among the variables. The ARDL bounds F-test is used for this purpose. A long-run relationship is confirmed when the F-statistic exceeds the upper bound critical values at the 5% or 10% significance level. In Model 1, the F-statistic is 3.53, which is higher than the upper bound values at both 5% (3.50) and 10% (3.13). This confirms the existence of a long-run relationship. Similarly, Model 2 shows an F-statistic of 3.82, exceeding the upper bound at both significance levels, indicating a long-run relationship.

For Model 3, the F-statistic value of 3.63 is greater than the upper bound values at 5% and 10%, confirming long-run association among the variables. In Model 4, the F-statistic is 3.52, which also exceeds the upper bound critical values, indicating a long-run relationship.

Model 5 reports an F-statistic of 3.64, which is higher than the upper bound values at both 5% and 10%, confirming long-run linkage. Finally, in Model 6, the F-statistic value of 4.01 exceeds the upper bound critical values at both significance levels, providing strong evidence of a long-run relationship among the variables

***Long Run Analysis*:** In this section, we present the long-run results. There are six models of PHCR with fiscal decentralization. These six models are divided into two parts one is "unadjusted decentralization," and the other is "adjusted decentralization". Each model having a different type of decentralization, including revenue decentralization (RD), expenditure decentralization (ED), combined decentralization (CD), adjusted revenue decentralization (ARD), adjusted expenditure decentralization (AED) and

adjusted combine decentralization (ACD). The rest of the variables are the same in each model.

***Unadjusted Decentralization*:** Unadjusted decentralization is further divided into three parts. These are "Revenue Decentralization", "Expenditures Decentralization" and "Combined Decentralization".

***Model 1. Unadjusted Revenue Decentralization, Governance and Poverty*:** The coefficient value of RD is -09714. The negative sign shows there is a negative relationship between PHCR and RD. A one percent increase in RD will reduce PHCR by 0.9714 percent. The probability value 0.0025 shows there is highly significant relationship exists between RD and PHCR. These results matched with the findings of Ramirez *et al*. (2016) and Maharajabdinul *et al*. (2015). Due to an increase in revenue because of decentralization, the government increases development and non-development expenditures. Expenditures create new jobs, and they reduce poverty in the economy. The concerned authorities may increase RD to reduce poverty.

There is a negative relationship between governance index (GI) and the poverty headcount ratio (PHCR), as indicated by the coefficient value of −0.3057. This implies that a one percent increase in GI reduces PHCR by 0.3057 percent. The relationship is statistically significant, with a probability value of 0.0899. These findings are consistent with Kwon and Kim (2014) and Sebudubudu (2010). Better governance improves development spending, creates employment opportunities, and raises per capita income and GDP, which

Table 6. Long-run Estimates of Poverty.

	Dependent Variable: PHCR					
	Unadjusted Decentralization			Adjusted Decentralization		
Variables	**1**	**2**	**3**	**4**	**5**	**6**
C	2.0164	1.3399	1.0006	0.3718	3.0162	-0.3496
	(0.1738)	(0.0000)	(0.0022)	(0.2592)	(0.0000)	(0.0000)
RD	-0.9714	---	---	---	---	---
	(0.0025)					
ED	---	-5.9471	---	---	---	---
		(0.0566)				
CD	---	---	-0.1660	---	---	---
			(0.0006)			
ARD	---	---	---	-0.0900	---	---
				(0.0000)		
AED	---	---	---	---	-6.5922	---
					(0.0098)	
ACD	---	---	---	---	---	-0.4299
						(0.0569)
GI	-0.3057	-3.8079	-0.3641	-0.9472	-1.0007	-4.3091
	(0.0899)	(0.0008)	(0.0021)	(0.0055)	(0.0993)	(0.0435)
RD*GI	-0.7070	---	---	---	---	---
	(0.0594)					
ED*GI	---	-9.3434	---	---	---	---
		(0.0006)				
CD*GI	---	---	-0.1851	---	---	---
			(0.0628)			
ARD*GI	---	---		-0.4494	---	---
				(0.0113)		
AED*GI	---	---			-6.5907	---
					(0.0025)	
ACD*GI	---	---				-0.7044
						(0.0176)
GDPG	-0.5432	-0.0507	-0.3669	-1.0060	-0.9129	-0.9052
	(0.0370)	(0.9694)	(0.1218)	(0.0039)	(0.0293)	(0.4055)
GINI	0.8821	0.3232	0.8557	0.9110	6.4126	2.5625
	(0.0133)	(0.1014)	(0.0088)	(0.0021)	(0.0008)	(0.0000)
CREDIT	-0.4559	-6.8141	-0.1476	-0.1852	-3.1429	-5.4490
	(0.0668)	(0.0000)	(0.1090)	(0.0946)	(0.0675)	(0.0000)
TRADE	-1.1527	-0.3316	-0.8795	-0.0829	-0.4207	-0.6519
	(0.0560)	(0.0198)	(0.0000)	(0.1322)	(0.0050)	(0.0000)
M2	4.1534	0.1074	0.8956	0.4973	3.0908	4.7548
	(0.1913)	(0.0001)	(0.0005)	(0.0658)	(0.0004)	(0.0376)

ultimately helps reduce poverty. Therefore, effective governance plays an important role in poverty reduction.

The interaction term RD×GI also shows a negative and significant relationship with PHCR. The coefficient value of −0.7070 indicates that a one percent increase in the interaction term reduces PHCR by 0.7070 percent. The probability value of 0.0594 confirms the statistical significance of this relationship.

PHCR is negatively related to GDP growth (GDPG), as shown by the coefficient value of −0.5432. This suggests that a one percent increase in GDPG leads to a 0.5432 percent reduction in poverty. The relationship is statistically significant, with a probability value of 0.0370. These results are supported by Afzal et al. (2012) and Agrawal (2007). Higher GDP growth increases per capita income, industrial activity, investment, and employment, which helps reduce poverty. Therefore, policies aimed at promoting economic growth can contribute to poverty reduction.

The coefficient of the Gini index (GINI) is positive at 0.8821, indicating a positive relationship between income inequality and poverty. A one percent increase in GINI increases PHCR by 0.8821 percent. The probability value of 0.0133 shows that this relationship is statistically significant. These findings are consistent with Wen et al. (2003) and Milanovic (1996). Rising income inequality increases the vulnerability of low-income groups, reduces productivity, and worsens poverty. Hence, policymakers should focus on reducing income inequality to control poverty.

CREDIT is negatively related to PHCR, with a coefficient value of −0.4559. This indicates that a one percent increase in credit reduces poverty by 0.4559 percent. The relationship is statistically significant, as shown by the probability value of 0.0668. These results are supported by Shirazi and Khan (2009) and Saboor et al. (2009). Increased access to credit encourages investment, raises output and exports, and increases GDP and per capita income, which ultimately helps reduce poverty. Therefore, expanding credit availability can be an effective tool for poverty reduction.

TRADE also has a negative and significant relationship with PHCR. The coefficient value of −1.1527 shows that a one percent increase in trade reduces poverty by 1.1527 percent. The probability value of 0.0560 confirms the significance of this relationship. These findings are in line with Cockburn (2006) and Siddiqui and Kemal (2006). Increased trade boosts employment, output, and exports, leading to higher GDP and per capita income, which helps lower poverty levels.

Finally, broad money supply (M2) shows a positive relationship with PHCR, as indicated by the coefficient value of 4.1534. This suggests that a one percent increase in M2 raises poverty by 4.1534 percent. However, this relationship is statistically insignificant, with a probability value of 0.1913. Similar findings are reported by Blattman and Niehaus (2014) and Spinney and Millward (2010). An increase in money supply may lead to higher inflation, which disproportionately affects low-income groups and increases poverty. Therefore, controlling excessive monetary expansion may help reduce poverty.

Model 2. Unadjusted Expenditure Decentralization, Governance and Poverty: The coefficient of expenditure decentralization (ED) is −5.9471, indicating a negative relationship with PHCR. This means that a 1% increase in ED reduces PHCR by 5.9471%. The probability value of 0.0566 shows that this relationship is statistically significant. These results are consistent with Udoh et al. (2015) and Kusumaningrum (2013). Efficient use of government expenditure by local authorities, especially on development projects, creates jobs and reduces poverty. Therefore, policymakers may consider increasing ED to lower poverty.

Governance index (GI) is also negatively related to PHCR, with a coefficient of −3.8079 and a highly significant probability value of 0.0008. This implies that a 1% improvement in GI reduces PHCR by 3.8079%. Better governance facilitates effective development spending, increases employment and per capita income, and consequently reduces poverty. These findings align with Sebudubudu (2010) and Aminuzzaman (2007).

The interaction term EDGI has a coefficient of −9.3434 with a probability value of 0.0006, showing a strong negative relationship with PHCR. A 1% increase in EDGI is associated with a 9.3434% decline in PHCR, indicating that decentralization combined with good governance significantly reduces poverty.

GDP growth (GDPG) has a coefficient of −0.0507, suggesting a negative relationship with PHCR. However, the probability value of 0.9694 indicates that this relationship is statistically insignificant. This finding is supported by Agarwal (2007) and Gupta and Mitra (2004). While higher GDPG may raise per capita income and employment, its direct effect on poverty reduction in this study is not significant.

The Gini coefficient has a positive coefficient of 0.3232, indicating that higher income inequality increases PHCR by 0.3232%. The relationship is insignificant (probability value 0.1014), consistent with Milanovic (1996) and Jafri and Khattak (1995). Higher inequality reduces productivity and worsens poverty. Policymakers may aim to reduce inequality to lower poverty.

Credit (CREDIT) has a coefficient of −6.8141 and is highly significant (probability 0.0000). A 1% increase in credit reduces PHCR by 6.8141%. These results align with Saboor et al. (2009) and Mazumder and Wencong (2013). Increased credit reduces interest rates, stimulates investment, raises output and exports, increases GDP and per capita income, and ultimately lowers poverty. Expanding credit availability can thus help reduce poverty.

Trade has a negative coefficient of −0.3316 with a significant probability of 0.0198, indicating that a 1% increase in trade reduces PHCR by 0.3316%. These findings are consistent with Siddiqui and Kemal (2006) and Hertel and Reimer

(2005). Higher trade boosts employment, output, net exports, GDP, and per capita income, leading to reduced poverty.

Broad money (M2) is positively related to PHCR, with a coefficient of 0.1074 and a highly significant probability value of 0.0001. A 1% increase in M2 raises PHCR by 0.1074%. This suggests that higher money supply may fuel inflation, which in turn increases poverty. These findings are supported by Spinney and Millward (2010) and Nelson (2001). To reduce poverty, authorities may consider controlling excessive growth in M2.

***Model 3: Unadjusted Combined Decentralization, Governance and Poverty*:** The coefficient of composite decentralization (CD) is −0.1660, indicating a negative relationship with PHCR. This means that a 1% increase in CD reduces PHCR by 0.1660%. The probability value of 0.0006 shows that this relationship is highly significant. These findings are consistent with Faridi and Nazar (2013) and Banwo (2012). Higher composite decentralization improves revenue collection and allows local authorities to efficiently allocate development and non-development expenditures, creating new jobs and reducing poverty. Authorities may therefore consider increasing CD to further alleviate poverty.

The governance index (GI) has a coefficient of −0.3641 and a probability value of 0.0021, indicating a significant negative relationship with PHCR. A 1% increase in GI reduces PHCR by 0.3641%. These results align with Aminuzzaman (2007) and Kwon and Kim (2014). Better governance ensures effective development spending, increases employment and per capita income, and reduces poverty.

The interaction term CD*GI has a coefficient of −0.1851, showing a negative relationship with PHCR. A 1% increase in CD*GI reduces PHCR by 0.1851%, and the probability value of 0.0628 indicates a significant effect.

GDP growth (GDPG) has a negative coefficient of −0.3669, suggesting that a 1% increase in GDPG reduces PHCR by 0.3669%. However, the relationship is statistically insignificant (probability = 0.1218). These findings are supported by Gupta and Mitra (2004) and Afzal et al. (2012). Higher GDP growth increases per capita income, industrialization, investment, and employment, which can reduce poverty.

The Gini coefficient has a positive coefficient of 0.8557 and a probability value of 0.0088, indicating a significant positive relationship with PHCR. A 1% increase in GINI increases PHCR by 0.8557%. This aligns with Jafri and Khattak (1995) and Wen et al. (2003). Higher income inequality exacerbates poverty by reducing the productivity and income of low-income individuals. Policies aimed at reducing GINI can therefore help lower poverty.

Credit availability (CREDIT) has a coefficient of −0.1476, showing a negative relationship with PHCR. A 1% increase in CREDIT reduces PHCR by 0.1476%, though the relationship is statistically insignificant (probability = 0.1090). These findings are consistent with Mazumder and Wencong (2013) and Shirazi and Khan (2009). Increased credit reduces interest rates, encourages investment, raises GDP and per capita income, and can help reduce poverty.

Trade openness (TRADE) has a coefficient of −0.8795 and a probability value of 0.0000, indicating a strong negative and highly significant relationship with PHCR. A 1% increase in TRADE reduces PHCR by 0.8795%. This supports Hertel and Reimer (2005) and Cockburn (2006). Increased trade boosts employment, output, GDP, and per capita income, thereby reducing poverty.

Broad money (M2) has a coefficient of 0.8956, indicating a positive relationship with PHCR. A 1% increase in M2 raises PHCR by 0.8956%, with a highly significant probability value of 0.0005. This aligns with Nelson (2001) and Blattman and Niehaus (2014). An increase in broad money supply can lead to higher inflation, which in turn increases poverty. Authorities may consider controlling money supply to reduce poverty

Adjusted Decentralization Models

Adjusted decentralization is further divided into three parts. These are “adjusted revenue decentralization”, “adjusted expenditures decentralization” and “adjusted combined decentralization”.

***Model 4: Adjusted Revenue Decentralization, Governance and Poverty*:** The coefficient of **ARD** is -0.0900, indicating a negative relationship with PHCR. This means a 1% increase in ARD reduces PHCR by 0.0900%. The probability value of 0.00 shows the relationship is highly significant. These results align with Ramirez et al. (2016) and Sepulveda & Martinez-Vazquez (2011). Increased decentralized revenue allows governments to raise development and non-development expenditures, creating jobs and reducing poverty. Authorities may increase ARD to lower poverty.

Governance (GI) is also negatively related to PHCR (coefficient = -0.9472), meaning a 1% improvement in governance reduces PHCR by 0.9472%. Its probability value is 0.0055, indicating high significance. Better governance increases development spending, job opportunities, and per capita income, thus reducing poverty, supported by Sebudubudu (2010) and Hyden (2007).

The interaction term ARD*GI has a coefficient of -0.4494, showing that combined improvements in decentralization and governance reduce PHCR by 0.4494%. The relationship is significant (p = 0.0113).

GDP growth (GDPG) is negatively related to PHCR (coefficient = -1.0060), meaning a 1% increase in GDPG reduces PHCR by 1.0060% (p = 0.0039). This supports findings by Agarwal (2007) and Donaldson (2008). Higher GDPG boosts income, investment, industrialization, and employment, reducing poverty.

Income inequality (GINI) is positively related to PHCR (coefficient = 0.9116, p = 0.0021). A 1% increase in GINI raises PHCR by 0.9116%. Increased inequality worsens

Table 7. Error Correction Estimates.

Models	COINTEQ01 coefficient	Prob.
PHCR/ **RD**, GI, RD*GI, GDPG, GINI, CREDIT, TRADE, M2	-4.4551	0.0094
PHCR/ **ED**, GI, ED*GI, GDPG, GINI, CREDIT, TRADE, M2	-0.6192	0.0325
PHCR/ **CD**, GI, CD*GI, GDPG, GINI, CREDIT, TRADE, M2	-0.8881	0.0006
PHCR/ **ARD**, GI, ARD*GI, GDPG, GINI, CREDIT, TRADE, M2	-0.2039	0.0000
PHCR/ **AED**, GI, AED*GI, GDPG, GINI, CREDIT, TRADE, M2	-3.0901	0.0099
PHCR/ **ACD**, GI, ACD*GI, GDPG, GINI, CREDIT, TRADE, M2	-0.8847	0.0000

poverty by exploiting low-income individuals, as noted by Milanovic (1996) and Coulter et al. (1992).

Credit availability (CREDIT) negatively affects PHCR (coefficient = -0.1852, p = 0.0946). A 1% increase in credit reduces PHCR by 0.1852%. Increased credit lowers interest rates, boosts investment, GDP, and per capita income, thereby reducing poverty (Saboor et al., 2009; Malik & Nazli, 1999).

Trade openness (TRADE) is negatively related but not significant (coefficient = -0.0829, p = 0.1322). While increased trade can improve employment, output, and GDP, its effect on poverty is statistically insignificant here (Siddiqui & Kemal, 2006; Dollar & Kraay, 2004).

Broad money supply (M2) is positively related to PHCR (coefficient = 0.4973, p = 0.0658), indicating that higher money supply may increase poverty through inflation (Spinney & Millward, 2010; Williams, 1984).

***Model 5: Adjusted Expenditure Decentralization, Governance, and Poverty*:** AED negatively affects PHCR (coefficient = -6.5922, p = 0.0098). A 1% increase in AED reduces PHCR by 6.5922%. Local authorities use decentralized expenditures effectively to create jobs and reduce poverty (Udoh et al., 2015; Malik, 2008).

GI is negatively related to PHCR (coefficient = -1.0007, p = 0.0993), showing significant impact. Improved governance increases development spending and employment, reducing poverty (Hyden, 2007; Kwon & Kim, 2014).

The interaction term AED*GI reduces PHCR by 6.5907% (p = 0.0025), showing significant joint effects.

GDPG is negatively associated with PHCR (coefficient = -0.9129, p = 0.0293). Higher GDPG improves income, investment, and employment, reducing poverty (Suryahadi et al., 2012; Donaldson, 2008).

GINI positively affects PHCR (coefficient = 6.4126, p = 0.0008). Higher inequality increases poverty (Coulter et al., 1992; Wen et al., 2003).

CREDIT reduces PHCR (coefficient = -3.1429, p = 0.0675). More credit improves investment, GDP, and income, lowering poverty (Bakhtiari, 2006; Hanak, 2000).

TRADE negatively affects PHCR (coefficient = -0.4207, p = 0.0050). Increased trade creates jobs, raises output, and reduces poverty (Hertel et al., 2004; Cockburn, 2006).

M2 positively affects PHCR (coefficient = 3.0908, p = 0.0004). Higher money supply increases inflation and poverty (Williams, 1984; Blattman & Niehaus, 2014).

***Model 6: Adjusted Combined Decentralization, Governance, and Poverty*:** ACD reduces PHCR (coefficient = -0.4299, p = 0.0569). Aggregated decentralization increases government revenues and expenditures, creating jobs and reducing poverty (Kusumaningrum, 2013; Rao, 2002). GI negatively affects PHCR (coefficient = -4.3091, p = 0.0435). Better governance increases income and GDP, lowering poverty (Aminuzzaman, 2007; Hyden, 2007). ACD*GI reduces PHCR by 0.7044% (p = 0.0176), showing significant combined effects. GDPG negatively affects PHCR (coefficient = -0.9052, p = 0.4055), but the effect is not statistically significant (Gupta & Mitra, 2004; Suryahadi et al., 2012). GINI positively affects PHCR (coefficient = 2.5625, p = 0.0000). Higher inequality worsens poverty (Jafri & Khattak, 1995; Coulter et al., 1992). CREDIT negatively affects PHCR (coefficient = -5.4490, p = 0.0000). More credit improves investment and GDP, reducing poverty (Hanak, 2000; Hoque, 2004). TRADE negatively affects PHCR (coefficient = -0.6519, p = 0.0000). Increased trade boosts employment, GDP, and per capita income, reducing poverty (Hertel & Reimer, 2005; Hertel et al., 2004). M2 positively affects PHCR (coefficient = 4.7548, p = 0.0376). Higher money supply increases inflation, leading to higher poverty (Nelson, 2001; Williams, 1984).

***Error Correction Analysis*:** The speed of adjustment is shown by the error correction model, which indicates the estimated time period to restore the equilibrium point of the model. The value of the ECM coefficient shows to what extent (whether it is quick or slow) the model would achieve its level of equilibrium. It also shows the convergence or the divergence of the model. The positive sign of the coefficient shows the divergence, while the negative sign shows the convergence of the model toward the equilibrium. Whereas a positive sign also shows the downward trend and a negative sign shows the upward trend, it requires resolving the problem of deviation. In Table 7, there is the ECM of six models explaining each model's speed of adjustment toward the equilibrium. In each model, PHCR is the dependent variable, and the rest of the variables are independent.

The coefficient value of our first model is -4.4551, where the negative sign shows the convergence of the variable. Coefficient value -4.4551 suggests a high speed of adjustment to correct the deviation from the equilibrium point, which is almost four and a half years. The negative coefficient value -

0.6192 of the second model also shows the convergence of the variable. The result suggests more than half and less than one year to correct the dispersion from Mean value and there is low speed of adjustment. The third model coefficient value is -0.8881 which is also negative and shows the convergence of the variable. Coefficient value -0.8881 shows low speed of adjustment and less than one year is required to resolve the problem of deviation from equilibrium point.

The coefficient value of fourth model is -0.2039 where negative sign shows the convergence of the variable. Coefficient value -0.2039 suggests high speed of adjustment to correct the deviation from the equilibrium point which is less than one quarter of a year. The negative coefficient value -3.0901 of fifth model also shows the convergence of the variable. The result suggests more than three years correcting the dispersion from Mean value and there is low speed of adjustment. Sixth and last model coefficient value is -0.8847 which is also negative and shows the convergence of the variable. Coefficient value -0.8847 shows low speed of adjustment and less than one year is required to resolve the problem of deviation from equilibrium point.

***Conclusion and Policy Recommendations*:** This study aimed to investigate the impact of fiscal decentralization and good governance on poverty reduction in Pakistan from 1996 to 2022. The lack of data from previous years and limited research on fiscal decentralization presented significant obstacles to conducting this study. To address this, we employed ARDL estimation as some of the data exhibited stationarity at level I (0), while others showed stationarity at the first difference I(1). ARDL bounds analysis indicated the presence of a long-term relationship in each model. We introduced two types of fiscal decentralization: unadjusted and adjusted, resulting in three models for each type. In the unadjusted decentralization models, we examined the influence of revenue decentralization (RD), expenditure decentralization (ED), and combined decentralization (CD) on poverty, along with its interaction with governance. In the adjusted decentralization models, we explored the effects of adjusted revenue decentralization (ARD), adjusted expenditure decentralization (AED), and adjusted combined decentralization (ACD) on poverty, again considering the interplay with governance. In total, this study comprised six models. Our findings revealed that governance and decentralization (both unadjusted and adjusted) had a similar impact on PHCR. Notably, revenue decentralization, whether unadjusted or adjusted, was found to have a negative and highly significant effect on poverty. Expenditure decentralization (both adjusted and unadjusted) also had a negative and significant impact on poverty, with the magnitude of the effect being greater than that of revenue decentralization. Furthermore, unadjusted and adjusted combined decentralization was found to negatively and significantly affect poverty to the same extent as revenue decentralization. Concurrently, governance in all models also exerted a negative and significant influence on poverty. In conclusion, all six types of decentralization and governance were found to have a negative and significant impact on poverty. However, for achieving rapid poverty reduction, expenditure decentralization, whether unadjusted or adjusted, can play a pivotal role.

Our empirical results have significant policy implications for poverty reduction in Pakistan:

1. All forms of fiscal decentralization, whether adjusted or unadjusted, have a beneficial impact on poverty reduction in Pakistan. Hence, policymakers should consider both types of expenditure decentralization, whether adjusted or unadjusted.
2. This study also underscores the importance of effective governance in poverty reduction. Authorities can make substantial strides in reducing poverty by enhancing the quality of governance.
3. Economic growth is a potent tool for combating poverty. Policymakers should prioritize measures to enhance economic growth as a means of reducing poverty.
4. Income inequality is positively associated with poverty. To mitigate poverty, authorities should work on reducing income inequality.
5. Credit access plays a role in poverty reduction. Policymakers can contribute to poverty reduction by improving access to credit.
6. Enhancing trade in Pakistan can also be a strategy to reduce poverty. Authorities should focus on expanding trade as part of their efforts to reduce poverty.
7. An increase in broad money supply positively affects poverty as it leads to higher inflation rates. To eliminate poverty, policymakers should consider reducing the broad money supply.

***Acknowledgement*:** The authors thank their institutions and reviewers for support and valuable feedback.

***CRediT Author Statement*:** Jawad Asghar Shah conceptualized the study; Muhammad Ramzan Sheikh supervised; Irfan Hussain Khan assisted in data analysis; Muhammad Imran Mushtaq supported statistical validation; Sana Sultan prepared literature review and references.

***Conflict of Interest*:** The authors declare no conflict of interest.

***Ethical Statement*:** The study used secondary publicly available data and did not require ethical approval.

***Availability of Data*:** Data used are publicly accessible; additional information is available from the corresponding author upon request.

***Consent to Participate*:** Not applicable; no human participants were involved.

***Informed Consent*:** Not applicable.

***Consent for Publication*:** Not applicable; no individual data were used.

***SDGs addressed*:** 1: No Poverty (Primary SDG); 16: Peace, Justice, and Strong Institutions (Primary SDG); 10: Reduced Inequalities (Secondary SDG); 8: Decent Work and Economic Growth (Indirect SDG)

***Policy referred*:** Fiscal Decentralization Policy (Core Policy Framework); Governance Reform Policy; Poverty Alleviation and Social Protection Policies; Public Financial Management (PFM) Reforms.

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